Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
12.003	7	11	89.215	0.600	48.226	47.725	0.501	178.1	675	7.09	107.9
15.000	8	9	63.906	0.600	49.225	48.925	0.300	213.0	375	5.86	117.1
15.001	9	11	51.665	0.600	48.925	48.025	0.900	57.4	375	6.22	114.3
16.000	10	11	53.064	0.600	48.450	47.950	0.500	106.1	450	5.45	120.5
12.004	11	14	91.356	0.600	47.650	46.950	0.700	130.5	750	7.72	103.8
17.000	12	13	36.772	0.600	48.325	47.975	0.350	105.1	375	5.35	121.4
17.001	13	14	41.824	0.600	47.975	47.325	0.650	64.3	375	5.66	118.8
12.005	14	16	89.902	0.600	46.800	46.641	0.159	565.4	900	8.86	97.1
18.000	15	16	72.224	0.600	47.725	47.166	0.559	129.2	375	5.76	118.0
12.006	16	47	16.000	0.600	46.491	46.475	0.016	1000.0	1050	9.11	95.7
1.000	17	18	62.302	0.600	49.350	49.050	0.300	207.7	450	5.74	118.1
1.001	18	19	43.531	0.600	49.050	48.800	0.250	174.1	450	6.21	114.4
1.002	19	20	43.958	0.600	48.650	48.550	0.100	439.6	600	6.84	109.7
1.003	20	21	82.803	0.600	48.550	48.200	0.350	236.6	600	7.72	103.8
1.004	21	24	47.090	0.600	48.200	48.000	0.200	235.5	600	8.21	100.8
2.000	22	23	61.948	0.600	48.650	48.459	0.191	324.3	375	6.03	115.7
2.001	23	24	32.457	0.600	48.384	48.150	0.234	138.7	450	6.35	113.4
1.005	24	40	31.072	0.600	48.000	47.148	0.852	36.5	600	8.34	100.0
3.000	25	26	49.366	0.600	49.500	49.298	0.202	244.4	300	5.82	117.4
3.001	26	27	45.846	0.600	49.223	49.025	0.198	231.5	375	6.47	112.5
3.002	27	28	40.358	0.600	49.025	48.725	0.300	134.5	375	6.90	109.3
3.003	28	37	43.936	0.600	48.725	47.475	1.250	35.1	375	7.14	107.6
4.000	29	31	42.187	0.600	49.225	48.703	0.522	80.8	375	5.35	121.4
5.000	30	31	41.926	0.600	48.950	48.778	0.172	243.8	300	5.70	118.5
4.001	31	34	47.397	0.600	48.703	48.300	0.403	117.6	375	6.17	114.7
6.000	32	34	42.690	0.600	48.550	48.375	0.175	243.9	300	5.71	118.4
7.000	33	34	41.323	0.600	49.125	48.300	0.825	50.1	375	5.27	122.0
4.002	34	37	27.507	0.600	48.300	47.475	0.825	33.3	375	6.32	113.6
8.000	35	36	43.430	0.600	48.450	48.200	0.250	173.7	300	5.61	119.2
8.001	36	37	35.393	0.600	48.200	47.550	0.650	54.5	300	5.88	116.9
3.004	37	38	16.838	0.600	47.100	47.078	0.022	765.4	750	7.42	105.8
3.005	38	40	61.455	0.600	47.078	46.998	0.080	768.2	750	8.44	99.5
9.000	39	40	48.829	0.600	48.200	47.373	0.827	59.0	375	5.34	121.4
1.006	40	45	60.605	0.600	46.698	46.637	0.061	993.5	1050	9.37	94.4
10.000	41	42	34.112	0.600	48.125	47.924	0.201	169.7	225	5.57	119.5
10.001	42	45	51.343	0.600	47.849	47.387	0.462	111.1	300	6.14	114.9
11.000	43	44	33.751	0.600	47.800	47.600	0.200	168.8	300	5.47	120.4
11.001	44	45	26.409	0.600	47.600	47.387	0.213	124.0	300	5.78	117.8
1.007_1	45	47	33.120	0.600	46.637	46.475	0.162	204.4	1050	9.60	93.3
19.000	46	47	52.604	0.600	47.289	46.999	0.290	181.4	300	5.75	118.0
1.007	47	47_OUT	23.108	0.600	46.474	44.500	1.974	11.7	825	9.64	92.2

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node 47 Online Orifice Control

Flap Valve	x	Invert Level (m)	47.873	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.500		

Node 47 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.39600	Safety Factor	2.0	Invert Level (m)	46.474
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	130

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1706.0	3100.0	1.400	3327.0	3100.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	50.837	1.537	152.7	2.1995	0.0000	FLOOD RISK
15 minute summer	2	11	50.755	1.539	323.6	2.2024	0.0000	FLOOD RISK
15 minute summer	3	11	50.029	1.229	432.6	1.7592	0.0000	SURCHARGED
15 minute summer	4	12	50.002	0.577	143.5	0.8251	0.0000	SURCHARGED
15 minute summer	5	12	49.909	0.859	287.2	1.2288	0.0000	SURCHARGED
15 minute summer	6	12	49.765	1.090	142.0	1.5593	0.0000	SURCHARGED
15 minute summer	7	12	49.516	1.290	800.3	2.2790	0.0000	SURCHARGED
15 minute summer	8	11	50.215	0.990	143.5	1.4161	0.0000	SURCHARGED
15 minute summer	9	11	49.880	0.955	283.0	1.3670	0.0000	SURCHARGED
15 minute summer	10	12	48.891	0.441	142.0	0.6304	0.0000	OK
15 minute summer	11	12	48.815	1.165	1153.0	2.9639	0.0000	SURCHARGED
15 minute summer	12	11	49.042	0.717	142.0	1.0264	0.0000	SURCHARGED
15 minute summer	13	11	48.832	0.857	271.3	1.2266	0.0000	SURCHARGED
15 minute summer	14	12	47.908	1.108	1379.5	2.8187	0.0000	SURCHARGED
15 minute summer	15	10	47.985	0.260	142.0	0.3722	0.0000	OK
120 minute winter	16	118	47.469	0.978	531.8	2.9218	0.0000	OK
15 minute summer	17	11	50.851	1.501	190.8	2.1474	0.0000	FLOOD RISK
15 minute summer	18	11	50.613	1.563	372.5	2.2366	0.0000	FLOOD RISK
15 minute summer	19	11	49.907	1.257	548.5	2.2203	0.0000	SURCHARGED
15 minute summer	20	11	49.532	0.982	549.2	1.7345	0.0000	SURCHARGED
15 minute summer	21	11	48.906	0.706	550.1	1.2481	0.0000	SURCHARGED
15 minute summer	22	10	49.794	1.144	190.8	1.6368	0.0000	SURCHARGED
15 minute summer	23	10	49.152	0.768	378.9	1.0989	0.0000	SURCHARGED
15 minute summer	24	11	48.515	0.515	921.1	0.9096	0.0000	OK
15 minute summer	25	11	50.043	0.543	73.3	0.6139	0.0000	SURCHARGED
15 minute summer	26	11	49.816	0.593	138.1	0.8487	0.0000	SURCHARGED
15 minute summer	27	11	49.550	0.525	206.7	0.7507	0.0000	SURCHARGED
15 minute summer	28	11	49.034	0.309	266.5	0.4416	0.0000	OK
15 minute summer	29	11	49.857	0.632	99.2	0.9045	0.0000	SURCHARGED
15 minute summer	30	12	50.054	1.104	106.8	1.2490	0.0000	SURCHARGED
15 minute summer	31	12	49.750	1.047	186.6	1.4985	0.0000	SURCHARGED
15 minute summer	32	11	49.666	1.116	106.8	1.2621	0.0000	SURCHARGED
15 minute summer	33	12	49.397	0.272	99.2	0.3897	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	12.000	2	141.1	0.890	0.886	5.4254	
15 minute summer	2	12.001	3	317.5	2.004	1.224	10.2011	
15 minute summer	3	12.002	7	428.8	2.707	0.957	2.8881	
15 minute summer	4	13.000	5	143.7	1.310	0.556	9.2813	
15 minute summer	5	13.001	7	268.3	2.035	0.784	8.4797	
15 minute summer	6	14.000	7	128.9	1.217	1.164	5.3100	
15 minute summer	7	12.003	11	774.1	2.169	1.103	31.8478	
15 minute summer	8	15.000	9	139.5	1.320	1.021	7.0486	
15 minute summer	9	15.001	11	266.6	2.595	1.008	5.6985	
15 minute summer	10	16.000	11	141.3	1.660	0.450	8.3858	
15 minute summer	11	12.004	14	1140.4	2.591	1.055	40.2077	
15 minute summer	12	17.000	13	135.9	1.423	0.696	4.0558	
15 minute summer	13	17.001	14	270.5	2.453	1.083	4.6131	
15 minute summer	14	12.005	16	1408.8	2.278	1.690	52.3552	
15 minute summer	15	18.000	16	139.1	1.762	0.791	5.6998	
120 minute winter	16	12.006	47	520.9	1.487	0.556	13.4643	
15 minute summer	17	1.000	18	183.8	1.160	0.822	9.8713	
15 minute summer	18	1.001	19	366.5	2.313	1.499	6.8972	
15 minute summer	19	1.002	20	549.2	1.950	1.682	12.3820	
15 minute summer	20	1.003	21	550.1	1.953	1.232	23.3237	
15 minute summer	21	1.004	24	551.9	2.139	1.234	12.6909	
15 minute summer	22	2.000	23	188.1	1.706	1.703	6.8327	
15 minute summer	23	2.001	24	377.3	2.382	1.376	5.0445	
15 minute summer	24	1.005	40	919.0	3.543	0.804	8.3740	
15 minute summer	25	3.000	26	70.4	1.085	0.995	3.4763	
15 minute summer	26	3.001	27	138.3	1.254	1.055	5.0567	
15 minute summer	27	3.002	28	208.3	2.043	1.209	4.1839	
15 minute summer	28	3.003	37	259.5	2.794	0.767	4.5548	
15 minute summer	29	4.000	31	92.2	1.256	0.414	4.6531	
15 minute summer	30	5.000	31	94.5	1.342	1.334	2.9524	
15 minute summer	31	4.001	34	177.2	1.714	0.961	5.2278	
15 minute summer	32	6.000	34	101.1	1.436	1.428	3.0062	
15 minute summer	33	7.000	34	98.8	1.348	0.349	4.0505	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	34	12	49.319	1.019	354.4	1.4576	0.0000	SURCHARGED
15 minute summer	35	11	49.474	1.024	100.0	1.1579	0.0000	SURCHARGED
15 minute summer	36	11	49.111	0.911	159.9	1.0298	0.0000	SURCHARGED
15 minute summer	37	11	48.258	1.158	745.7	2.9473	0.0000	SURCHARGED
15 minute summer	38	11	48.122	1.044	752.6	2.6562	0.0000	SURCHARGED
15 minute summer	39	9	48.360	0.160	101.5	0.2295	0.0000	OK
15 minute summer	40	11	47.814	1.116	1757.8	3.3333	0.0000	SURCHARGED
15 minute summer	41	11	48.975	0.850	48.9	0.9608	0.0000	SURCHARGED
15 minute summer	42	11	48.640	0.791	144.5	0.8941	0.0000	SURCHARGED
15 minute summer	43	11	48.180	0.380	101.5	0.4295	0.0000	SURCHARGED
15 minute summer	44	11	47.875	0.275	99.7	0.3113	0.0000	OK
15 minute summer	45	11	47.476	0.839	1998.2	2.5059	0.0000	OK
15 minute summer	46	11	47.712	0.423	108.4	0.4780	0.0000	SURCHARGED
120 minute winter	47	118	47.469	0.995	1202.4	2271.9780	0.0000	SURCHARGED
15 minute summer	47_OUT	1	44.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	34	4.002	37	346.1	3.138	0.996	3.0339	
15 minute summer	35	8.000	36	93.4	1.326	1.111	3.0583	
15 minute summer	36	8.001	37	155.7	2.211	1.032	2.4924	
15 minute summer	37	3.004	38	752.6	1.710	1.698	7.4108	
15 minute summer	38	3.005	40	758.2	1.723	1.714	27.0476	
15 minute summer	39	9.000	40	101.1	2.114	0.387	3.7556	
15 minute summer	40	1.006	45	1754.6	2.096	1.868	48.5487	
15 minute summer	41	10.000	42	47.5	1.193	1.193	1.3567	
15 minute summer	42	10.001	45	145.2	2.062	1.378	3.5613	
15 minute summer	43	11.000	44	99.7	1.418	1.169	2.3307	
15 minute summer	44	11.001	45	98.5	1.564	0.988	1.7025	
15 minute summer	45	1.007_1	47	1990.8	2.809	0.956	23.4503	
15 minute summer	46	19.000	47	105.5	1.512	1.283	3.5095	
120 minute winter	47	Orifice	47_OUT	0.0				0.0
120 minute winter	47	Infiltration		170.5				

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	20	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	999.9		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.141	5.00	50.750	1200	618373.834	246723.352	1.382
3	0.198	5.00	51.100	1200	618458.853	246785.565	1.500
4	0.124	5.00	51.100	1500	618425.169	246769.536	2.239
5	0.160	5.00	51.200	1200	618482.461	246837.701	1.500
6	0.160	5.00	50.800	1350	618428.639	246810.153	1.575
7			50.200	1350	618404.398	246790.966	1.400
7_OUT			50.500	1350	618421.146	246818.956	3.500

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	4	69.052	0.600	49.368	49.086	0.282	244.9	300	6.15	106.2
2.000	3	4	37.303	0.600	49.600	49.086	0.514	72.6	300	5.34	112.6
1.001	4	7	29.844	0.600	48.861	48.800	0.061	489.3	525	6.65	102.7
3.000	5	6	60.462	0.600	49.700	49.300	0.400	151.2	300	5.79	109.0
3.001	6	7	30.915	0.600	49.225	48.875	0.350	88.3	375	6.06	106.9
1.004	7	7_OUT	32.618	0.600	48.800	47.000	1.800	18.1	450	6.76	96.3

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node 7 Online Orifice Control

Flap Valve	x	Invert Level (m)	50.100	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.500		

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03024	Safety Factor	2.0	Invert Level (m)	48.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1500

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	387.0	850.0	1.400	1030.0	850.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	49.927	0.559	107.6	0.6328	0.0000	SURCHARGED
15 minute summer	3	10	50.166	0.566	151.1	0.6399	0.0000	SURCHARGED
600 minute winter	4	600	49.794	0.933	31.1	1.6478	0.0000	SURCHARGED
15 minute summer	5	10	50.548	0.848	122.1	0.9588	0.0000	SURCHARGED
600 minute winter	6	600	49.794	0.569	21.4	0.8136	0.0000	SURCHARGED
600 minute winter	7	600	49.794	0.994	50.8	612.6185	0.0000	SURCHARGED
15 minute summer	7_OUT	1	47.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	4	102.4	1.471	1.448	4.6412	
15 minute summer	3	2.000	4	150.1	2.131	1.149	2.5920	
600 minute winter	4	1.001	7	30.4	0.712	0.140	6.4473	
15 minute summer	5	3.000	6	119.0	1.690	1.319	4.2577	
600 minute winter	6	3.001	7	20.9	0.798	0.098	3.4098	
600 minute winter	7	Orifice	7_OUT	0.0				0.0
600 minute winter	7	Infiltration		3.6				

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	50	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	999.9		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.157	5.00	51.000	1350	618620.098	246845.505	1.650
2	0.157	5.00	51.100	1350	618582.829	246909.357	1.932
3	0.134	5.00	50.900	1500	618540.598	246952.071	1.955
4	0.157	5.00	51.100	1350	618582.268	246840.464	1.650
5	0.134	5.00	51.100	1350	618527.407	246902.235	1.853
6	0.134	5.00	50.850	1500	618511.217	246967.607	2.048
7	0.157	5.00	50.900	1350	618584.279	246955.455	1.650
8	0.134	5.00	50.600	1350	618549.523	246993.361	1.650
9			50.450	1500	618511.593	247026.374	1.800
10	0.134	5.00	50.350	1350	618570.859	247019.127	1.650
11			50.050	1800	618566.775	247054.901	2.025
12	0.092	5.00	50.950	1350	618635.877	246870.927	1.650
13	0.103	5.00	51.000	1350	618617.514	246918.243	1.825
14	0.096	5.00	50.950	1350	618612.284	246961.670	1.883
15	0.303	5.00	50.450	1350	618602.882	247008.416	1.650
16	0.051	5.00	49.950	1800	618586.744	247062.845	2.025
17	0.181	5.00	51.000	1350	618672.608	246909.422	1.650
18	0.181	5.00	50.800	1350	618659.268	246950.379	1.650
19	0.181	5.00	50.850	1500	618705.242	246959.922	1.966
20			50.680	1500	618739.039	246962.727	1.855
21	0.181	5.00	50.450	1350	618648.395	247004.461	1.650
22	0.181	5.00	51.000	1350	618682.433	247023.048	2.296
23			49.950	1500	618717.040	247033.033	1.800
24	0.181	5.00	49.800	1350	618628.042	247047.246	1.650
25	0.181	5.00	50.200	1350	618660.326	247072.145	2.150
26			48.650	1800	618668.615	247102.988	2.025
27	0.106	5.00	48.950	1350	618610.757	247105.243	1.650
28			48.300	1800	618655.389	247120.149	2.025
29	0.106	5.00	48.150	1350	618586.651	247157.237	1.650
30	0.106	5.00	48.600	1350	618597.966	247129.703	1.650
31			47.800	1800	618634.127	247147.928	2.025
32	0.144	5.00	50.450	1350	618410.512	247079.271	1.650
33	0.144	5.00	50.200	1350	618399.192	247123.369	1.650
34			50.200	1350	618378.429	247134.239	1.708
35	0.144	5.00	49.050	1350	618540.115	247074.422	1.650
36	0.144	5.00	49.450	1350	618522.788	247113.903	2.156
37	0.144	5.00	49.850	1500	618508.794	247143.877	2.713
38	0.144	5.00	50.100	1350	618459.719	247096.817	1.650
39	0.144	5.00	49.700	1350	618453.482	247139.761	1.650
40			49.000	1500	618489.249	247171.022	1.931
41	0.065	5.00	49.500	1350	618579.615	247079.384	1.650
42	0.000	5.00	48.950	1350	618563.253	247125.653	1.650
43	0.133	5.00	48.350	1500	618543.243	247171.747	1.725
44			47.900	1500	618564.386	247183.012	1.725
45	0.192	5.00	49.980	1350	618328.382	247189.999	1.650
46	0.192	5.00	49.490	1350	618373.474	247198.435	1.650
47	0.192	5.00	48.790	1350	618430.706	247215.058	1.650
48	0.192	5.00	47.930	1350	618499.042	247225.949	1.650
49			47.102	1350	618555.570	247231.834	1.650
50			45.725	1800	618593.338	247236.784	1.679
31_OUT			45.600	1800	618643.160	247200.688	1.600
Dummy			45.634	1800	618646.160	247208.688	2.100

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	73.933	0.600	49.350	49.168	0.182	406.2	450	6.23	125.1
1.001	2	3	60.066	0.600	49.168	49.020	0.148	405.9	450	7.23	117.4
1.002	3	6	33.236	0.600	48.945	48.877	0.068	488.8	525	7.78	113.6
2.000	4	5	82.616	0.600	49.450	49.247	0.203	407.0	450	6.38	124.0
2.001	5	6	67.347	0.600	49.247	48.952	0.295	228.3	450	7.21	117.5
1.003	6	9	58.768	0.600	48.802	48.650	0.152	386.6	600	8.57	108.5
3.000	7	8	51.428	0.600	49.250	48.950	0.300	171.4	450	5.55	130.8
3.001	8	9	50.285	0.600	48.950	48.800	0.150	335.2	450	6.31	124.5
1.004	9	11	62.120	0.600	48.650	48.250	0.400	155.3	600	9.10	105.4
4.000	10	11	36.006	0.600	48.700	48.400	0.300	120.0	450	5.32	132.8
1.005	11	16	21.491	0.600	48.025	47.925	0.100	214.9	825	9.28	104.4
5.000	12	13	50.754	0.600	49.300	49.175	0.125	406.0	450	5.84	128.3
5.001	13	14	43.741	0.600	49.175	49.067	0.108	405.0	450	6.57	122.4
5.002	14	15	47.682	0.600	49.067	48.800	0.267	178.6	450	7.09	118.4
5.003	15	16	56.771	0.600	48.800	48.300	0.500	113.5	450	7.59	114.9
1.006	16	26	91.183	0.600	47.925	46.625	1.300	70.1	825	9.71	102.1
6.000	17	19	60.127	0.600	49.350	49.034	0.316	190.3	450	5.68	129.7
7.000	18	19	46.954	0.600	49.150	49.034	0.116	404.8	450	5.78	128.8
6.001	19	20	33.913	0.600	48.884	48.825	0.059	574.8	600	6.34	124.2
6.002	20	23	73.667	0.600	48.825	48.150	0.675	109.1	600	6.87	120.1
8.000	21	22	38.782	0.600	48.800	48.704	0.096	404.0	450	5.64	130.0
8.001	22	23	36.019	0.600	48.704	48.300	0.404	89.2	450	5.92	127.6
6.003	23	26	85.080	0.600	48.150	46.850	1.300	65.4	600	7.34	116.7
9.000	24	25	40.770	0.600	48.150	48.050	0.100	407.7	450	5.68	129.7
9.001	25	26	31.937	0.600	48.050	47.000	1.050	30.4	450	5.82	128.5
1.007	26	28	21.666	0.600	46.625	46.275	0.350	61.9	825	9.81	101.5
10.000	27	28	47.055	0.600	47.300	46.650	0.650	72.4	450	5.33	132.8
1.008	28	31	34.982	0.600	46.275	45.775	0.500	70.0	825	9.97	100.7
11.000	29	31	48.380	0.600	46.500	46.150	0.350	138.2	450	5.47	131.6
12.000	30	31	40.494	0.600	46.950	46.150	0.800	50.6	450	5.24	133.6
1.009	31	31_OUT	53.528	0.600	45.775	44.075	1.700	31.5	825	10.14	99.8
13.000	32	33	45.528	0.600	48.800	48.550	0.250	182.1	450	5.50	131.2
13.001	33	34	23.436	0.600	48.550	48.492	0.058	404.1	450	5.89	127.9
13.002	34	40	116.765	0.600	48.492	47.144	1.348	86.6	450	6.78	120.7
14.000	35	36	43.116	0.600	47.400	47.294	0.106	406.8	450	5.72	129.4
14.001	36	37	33.080	0.600	47.294	47.212	0.082	403.4	450	6.27	124.8
14.002	37	40	33.449	0.600	47.137	47.069	0.068	491.9	525	6.82	120.4
15.000	38	39	43.395	0.600	48.450	48.050	0.400	108.5	450	5.37	132.4
15.001	39	40	47.503	0.600	48.050	47.144	0.906	52.4	450	5.65	129.9
13.003	40	43	53.999	0.600	47.069	46.625	0.444	121.6	525	7.26	117.2
16.000	41	42	49.077	0.600	47.850	47.300	0.550	89.2	450	5.38	132.3
16.001	42	43	50.250	0.600	47.300	46.700	0.600	83.7	450	5.76	129.0
13.004	43	44	23.957	0.600	46.625	46.175	0.450	53.2	525	7.39	116.3
13.005	44	31_OUT	80.733	0.600	46.175	44.375	1.800	44.9	525	7.80	113.5
17.000	45	46	45.874	0.600	48.330	47.840	0.490	93.6	450	5.36	132.5
17.001	46	47	59.597	0.600	47.840	47.140	0.700	85.1	450	5.81	128.5
17.002	47	48	69.198	0.600	47.140	46.280	0.860	80.5	450	6.32	124.4
17.003	48	49	56.834	0.600	46.280	45.452	0.828	68.6	450	6.71	121.3
17.004	49	50	38.091	0.600	45.452	44.075	1.377	27.7	450	6.87	120.0
17.005	50	31_OUT	44.000	0.600	44.046	44.000	0.046	956.5	900	7.60	103.3
1.010	31_OUT	Dummy	8.544	0.600	44.000	43.534	0.466	18.3	900	10.16	89.0

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node 31_OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	45.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.500		

Node 50 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.20160	Safety Factor	2.0	Invert Level (m)	44.046
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	340

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	137.0	137.0	1.600	816.0	137.0

Node 31_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.20160	Safety Factor	2.0	Invert Level (m)	44.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	432

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1970.0	2400.0	1.600	3446.0	2400.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	12	50.772	1.422	119.8	2.0349	0.0000	FLOOD RISK
15 minute summer	2	12	50.700	1.532	233.0	2.1927	0.0000	SURCHARGED
15 minute summer	3	12	50.402	1.457	314.0	2.5743	0.0000	SURCHARGED
15 minute summer	4	11	50.774	1.324	119.8	1.8943	0.0000	SURCHARGED
15 minute summer	5	11	50.695	1.448	212.4	2.0715	0.0000	SURCHARGED
15 minute summer	6	12	50.229	1.427	599.1	2.5222	0.0000	SURCHARGED
15 minute summer	7	11	50.038	0.788	119.8	1.1272	0.0000	SURCHARGED
15 minute summer	8	11	49.945	0.995	213.6	1.4244	0.0000	SURCHARGED
15 minute summer	9	12	49.717	1.067	776.8	1.8849	0.0000	SURCHARGED
15 minute summer	10	10	48.891	0.191	102.2	0.2739	0.0000	OK
15 minute summer	11	12	48.752	0.727	854.5	1.8507	0.0000	OK
15 minute summer	12	11	50.106	0.806	70.2	1.1534	0.0000	SURCHARGED
15 minute summer	13	11	50.087	0.912	143.2	1.3046	0.0000	SURCHARGED
15 minute summer	14	11	50.045	0.978	204.4	1.3995	0.0000	SURCHARGED
15 minute summer	15	11	49.816	1.016	426.1	1.4540	0.0000	SURCHARGED
15 minute summer	16	12	48.639	0.714	1255.4	1.8159	0.0000	OK
15 minute summer	17	10	49.597	0.247	138.1	0.3532	0.0000	OK
15 minute summer	18	11	49.499	0.349	138.1	0.4996	0.0000	OK
15 minute summer	19	11	49.400	0.516	410.1	0.9114	0.0000	OK
15 minute summer	20	11	49.183	0.358	404.5	0.6322	0.0000	OK
15 minute summer	21	10	49.146	0.346	138.1	0.4952	0.0000	OK
15 minute summer	22	10	49.037	0.333	274.2	0.4763	0.0000	OK
15 minute summer	23	13	48.738	0.588	673.7	1.0389	0.0000	OK
15 minute summer	24	11	48.463	0.313	138.1	0.4472	0.0000	OK
15 minute summer	25	12	48.316	0.266	274.8	0.3812	0.0000	OK
15 minute summer	26	12	48.125	1.500	2004.6	3.8179	0.0000	SURCHARGED
15 minute summer	27	10	47.438	0.138	80.9	0.1979	0.0000	OK
15 minute summer	28	12	47.431	1.156	2072.2	2.9418	0.0000	SURCHARGED
15 minute summer	29	10	46.672	0.172	80.9	0.2464	0.0000	OK
15 minute summer	30	9	47.077	0.127	80.9	0.1820	0.0000	OK
15 minute summer	31	12	46.414	0.639	2200.0	1.6267	0.0000	OK
15 minute summer	32	10	49.009	0.209	109.9	0.2990	0.0000	OK
15 minute summer	33	12	48.948	0.398	218.8	0.5688	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	113.2	0.778	0.710	11.7142	
15 minute summer	2	1.001	3	216.5	1.366	1.357	9.5171	
15 minute summer	3	1.002	6	301.8	1.397	1.385	7.1801	
15 minute summer	4	2.000	5	114.9	0.937	0.721	13.0900	
15 minute summer	5	2.001	6	213.2	1.346	1.000	10.6707	
15 minute summer	6	1.003	9	576.3	2.046	1.654	16.5536	
15 minute summer	7	3.000	8	116.1	1.023	0.471	8.1484	
15 minute summer	8	3.001	9	200.5	1.320	1.142	7.9673	
15 minute summer	9	1.004	11	771.5	2.740	1.398	17.1569	
15 minute summer	10	4.000	11	101.0	1.648	0.343	3.3062	
15 minute summer	11	1.005	16	831.3	2.163	0.770	10.6121	
15 minute summer	12	5.000	13	71.4	0.642	0.448	8.0416	
15 minute summer	13	5.001	14	140.2	1.032	0.878	6.9305	
15 minute summer	14	5.002	15	205.6	1.335	0.852	7.5549	
15 minute summer	15	5.003	16	393.6	2.484	1.298	8.8523	
15 minute summer	16	1.006	26	1214.1	2.411	0.640	46.6454	
15 minute summer	17	6.000	19	138.1	1.243	0.591	6.7506	
15 minute summer	18	7.000	19	133.9	1.049	0.839	6.3385	
15 minute summer	19	6.001	20	404.5	1.890	1.419	7.3419	
15 minute summer	20	6.002	23	406.1	2.076	0.616	16.0882	
15 minute summer	21	8.000	22	136.1	1.061	0.852	4.9748	
15 minute summer	22	8.001	23	269.4	2.287	0.786	4.7579	
15 minute summer	23	6.003	26	624.3	2.543	0.733	23.9030	
15 minute summer	24	9.000	25	136.7	1.420	0.859	4.3093	
15 minute summer	25	9.001	26	261.0	3.114	0.444	4.0902	
15 minute summer	26	1.007	28	2007.1	3.765	0.994	11.5509	
15 minute summer	27	10.000	28	80.3	1.660	0.211	4.6757	
15 minute summer	28	1.008	31	2068.2	3.983	1.089	17.0774	
15 minute summer	29	11.000	31	80.4	1.424	0.293	3.4367	
15 minute summer	30	12.000	31	80.9	2.078	0.178	2.5909	
15 minute summer	31	1.009	31_OUT	2179.6	5.465	0.769	21.3617	
15 minute summer	32	13.000	33	108.9	0.991	0.456	4.9397	
15 minute summer	33	13.001	34	215.2	1.824	1.346	3.2241	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	34	12	48.828	0.336	215.2	0.4808	0.0000	OK
15 minute summer	35	11	48.886	1.486	109.9	2.1264	0.0000	FLOOD RISK
15 minute summer	36	11	48.836	1.542	209.1	2.2060	0.0000	SURCHARGED
15 minute summer	37	12	48.683	1.546	310.5	2.7314	0.0000	SURCHARGED
15 minute summer	38	12	48.772	0.322	109.9	0.4608	0.0000	OK
15 minute summer	39	12	48.756	0.706	219.0	1.0098	0.0000	SURCHARGED
15 minute summer	40	12	48.553	1.484	672.5	2.6217	0.0000	SURCHARGED
15 minute summer	41	10	47.968	0.118	49.6	0.1689	0.0000	OK
15 minute summer	42	12	47.495	0.195	49.2	0.2789	0.0000	OK
15 minute summer	43	12	47.466	0.841	722.6	1.4862	0.0000	SURCHARGED
15 minute summer	44	12	46.648	0.473	720.7	0.8363	0.0000	OK
15 minute summer	45	11	49.239	0.909	146.5	1.3005	0.0000	SURCHARGED
15 minute summer	46	11	49.154	1.314	281.3	1.8800	0.0000	SURCHARGED
15 minute summer	47	11	48.733	1.593	411.5	2.2800	0.0000	FLOOD RISK
15 minute summer	48	12	47.555	1.275	523.1	1.8243	0.0000	SURCHARGED
15 minute summer	49	12	45.804	0.352	511.1	0.5031	0.0000	OK
240 minute winter	50	240	45.193	1.147	108.3	439.1694	0.0000	SURCHARGED
240 minute winter	31_OUT	240	45.193	1.193	672.2	3009.5370	0.0000	SURCHARGED
15 minute summer	Dummy	1	43.534	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	34	13.002	40	204.0	1.458	0.587	16.6622	
15 minute summer	35	14.000	36	103.3	0.652	0.649	6.8314	
15 minute summer	36	14.001	37	205.7	1.298	1.286	5.2413	
15 minute summer	37	14.002	40	304.8	1.411	1.404	7.2261	
15 minute summer	38	15.000	39	109.1	1.522	0.352	6.0716	
15 minute summer	39	15.001	40	200.1	1.746	0.447	7.5265	
15 minute summer	40	13.003	43	617.8	2.860	1.406	11.6656	
15 minute summer	41	16.000	42	49.2	1.558	0.144	2.2855	
15 minute summer	42	16.001	43	60.5	0.641	0.171	5.6330	
15 minute summer	43	13.004	44	720.7	3.339	1.083	5.0437	
15 minute summer	44	13.005	31_OUT	720.4	3.773	0.993	15.5942	
15 minute summer	45	17.000	46	143.6	1.432	0.430	7.2684	
15 minute summer	46	17.001	47	271.7	1.831	0.775	9.4428	
15 minute summer	47	17.002	48	383.3	2.420	1.063	10.9640	
15 minute summer	48	17.003	49	511.1	3.305	1.308	8.2783	
15 minute summer	49	17.004	50	517.0	4.010	0.838	5.0898	
240 minute winter	50	17.005	31_OUT	23.7	0.540	0.037	27.8860	
240 minute winter	50	Infiltration		3.8				
240 minute winter	31_OUT	Orifice	Dummy	0.0				0.0
240 minute winter	31_OUT	Infiltration		67.2				

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	30	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	999.9		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.163	5.00	48.600	1200	618858.309	246496.835	1.500
2	0.000	5.00	48.000	1200	618797.843	246432.591	1.405
3	0.163	5.00	48.050	1200	618863.333	246434.656	1.500
4	0.000	5.00	47.850	1350	618882.506	246396.442	1.781
5	0.163	5.00	48.400	1350	618900.855	246486.922	1.500
6	0.000	5.00	48.150	1350	618960.862	246485.952	1.575
7	0.163	5.00	48.100	1200	618902.411	246458.749	1.500
8	0.000	5.00	47.900	1350	618951.153	246429.470	1.608
4_OUT			47.400	1350	618910.292	246400.509	1.400
DUMMY			47.400	1350	618910.971	246394.876	1.650

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	88.224	0.600	47.100	46.595	0.505	174.7	300	6.24	114.2
1.001	2	4	92.057	0.600	46.595	46.219	0.376	244.8	300	7.77	103.5
2.000	3	4	42.754	0.600	46.550	46.219	0.331	129.2	300	5.52	120.0
1.002	4	4_OUT	28.082	0.600	46.069	46.000	0.069	407.0	450	8.24	100.6
3.000	5	6	60.015	0.600	46.900	46.575	0.325	184.7	375	5.75	118.0
3.001	6	8	57.310	0.600	46.575	46.292	0.283	202.5	375	6.50	112.2
4.000	7	8	56.860	0.600	46.600	46.367	0.233	244.0	300	5.95	116.4
3.002	8	4_OUT	50.084	0.600	46.292	46.075	0.217	230.8	375	7.21	107.1
1.003	4_OUT	DUMMY	5.674	0.600	46.000	45.750	0.250	22.7	450	8.26	100.5

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node 4_OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	47.300	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.500		

Node 4_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.12960	Safety Factor	2.0	Invert Level (m)	46.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	696

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	318.9	318.9	1.400	1142.4	318.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.78%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	48.263	1.163	124.4	1.3153	0.0000	SURCHARGED
15 minute summer	2	12	47.271	0.676	117.0	0.7643	0.0000	SURCHARGED
15 minute summer	3	10	47.050	0.500	124.4	0.5659	0.0000	SURCHARGED
360 minute winter	4	352	46.777	0.708	33.5	1.0134	0.0000	SURCHARGED
15 minute summer	5	11	47.500	0.600	124.4	0.8584	0.0000	SURCHARGED
15 minute summer	6	11	47.246	0.671	130.7	0.9598	0.0000	SURCHARGED
15 minute summer	7	11	47.772	1.172	124.4	1.3253	0.0000	SURCHARGED
15 minute summer	8	12	47.058	0.766	218.3	1.0966	0.0000	SURCHARGED
360 minute winter	4_OUT	352	46.777	0.777	62.0	426.5699	0.0000	SURCHARGED
15 minute summer	DUMMY	1	45.750	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	117.0	1.661	1.395	6.2127	
15 minute summer	2	1.001	4	104.9	1.504	1.484	6.1351	
15 minute summer	3	2.000	4	121.6	1.728	1.245	2.9149	
360 minute winter	4	1.002	4_OUT	31.7	0.802	0.199	4.4494	
15 minute summer	5	3.000	6	130.7	1.479	0.890	6.6195	
15 minute summer	6	3.001	8	108.4	1.024	0.773	6.3211	
15 minute summer	7	4.000	8	121.8	1.730	1.720	4.0040	
15 minute summer	8	3.002	4_OUT	219.1	1.988	1.670	5.3662	
360 minute winter	4_OUT	Orifice	DUMMY	0.0				0.0
360 minute winter	4_OUT	Infiltration		5.7				

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	30	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	999.9		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.110	5.00	47.550	1200	619026.248	246460.520	1.500
2	0.110	5.00	46.900	1350	619107.295	246442.617	1.575
3	0.000	5.00	46.900	1350	619135.884	246450.319	1.667
4	0.110	5.00	47.600	1200	618985.786	246441.839	1.500
5	0.110	5.00	47.050	1350	619047.802	246432.929	1.575
6	0.110	5.00	46.800	1350	619102.824	246424.488	1.650
7	0.000	5.00	46.700	1350	619147.427	246399.215	1.704
8_OUT			46.075	1500	619139.403	246375.745	1.400
DUMMY			46.075	1500	619136.539	246370.895	2.075

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	1	2	83.001	0.600	46.050	45.400	0.650	127.7	300	6.00	116.0
2.001	2	3	29.608	0.600	45.325	45.233	0.092	321.8	375	6.49	112.3
2.002	3	7	52.391	0.600	45.233	45.071	0.162	323.4	375	7.36	106.2
1.000	4	5	62.653	0.600	46.100	45.550	0.550	113.9	300	5.71	118.4
1.001	5	6	55.666	0.600	45.475	45.225	0.250	222.7	375	6.48	112.4
1.002	6	7	51.266	0.600	45.150	44.996	0.154	332.9	450	7.25	106.9
1.003	7	8_OUT	24.804	0.600	44.996	44.750	0.246	100.8	450	7.56	104.8
1.004	8_OUT	DUMMY	5.632	0.600	44.675	44.000	0.675	8.3	525	7.57	102.9

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node 8_OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	46.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.500		

Node 8_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.08640	Safety Factor	2.0	Invert Level (m)	44.675
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1650

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	198.0	198.0	1.400	889.0	198.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	46.657	0.607	83.9	0.6867	0.0000	SURCHARGED
15 minute summer	2	11	46.180	0.855	158.2	1.2229	0.0000	SURCHARGED
15 minute summer	3	11	45.954	0.721	147.8	1.0312	0.0000	SURCHARGED
15 minute summer	4	11	46.727	0.627	83.9	0.7095	0.0000	SURCHARGED
15 minute summer	5	11	46.373	0.898	158.3	1.2844	0.0000	SURCHARGED
15 minute summer	6	11	45.966	0.816	234.1	1.1676	0.0000	SURCHARGED
720 minute winter	7	705	45.637	0.641	31.3	0.9175	0.0000	SURCHARGED
720 minute winter	8_OUT	705	45.637	0.962	29.6	420.6388	0.0000	SURCHARGED
15 minute summer	DUMMY	1	44.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	2.000	2	75.3	1.202	0.767	5.8449	
15 minute summer	2	2.001	3	147.8	1.340	1.333	3.2657	
15 minute summer	3	2.002	7	149.4	1.354	1.350	5.7786	
15 minute summer	4	1.000	5	78.3	1.337	0.752	4.4120	
15 minute summer	5	1.001	6	154.1	1.397	1.153	6.1398	
15 minute summer	6	1.002	7	229.8	1.450	1.303	8.1228	
720 minute winter	7	1.003	8_OUT	29.6	0.799	0.092	3.9300	
720 minute winter	8_OUT	Orifice	DUMMY	0.0				0.0
720 minute winter	8_OUT	Infiltration		2.4				

APPENDIX I
PROPOSED SURFACE WATER DRAINAGE STRATEGY

MP 73.0

MP 73.25

SP

MP 73.5

LC

Catchment 3f
Development area = 1.28ha
Impermeability = 60%
Impermeable area = 0.77ha

Basin 3b

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels.

Target infiltration depth = 2.8m
Infiltration rate = $5.6x10^{-5}$ m/s
Anticipated infiltration area = $137m^2$
Water depth (1in100+45%CC) = 1.147m
Freeboard = 453mm
Basin plan area = $816m^2$

Borehole log BH1
Reference = 16188SI
Infiltration testing depth = 4.5m
Infiltration rate = $5.6x10^{-6}$m/s

Basin 3a

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels.

Target infiltration depth = 2.8m
Infiltration rate = $5.6x10^{-5}$ m/s
Anticipated infiltration area = $2400m^2$
Water depth (1in100+45%CC) = 1.193m
Freeboard = 407mm
Basin plan area = $3446m^2$

Catchment 3d
Development area = 0.54ha
Impermeability = 60%
Impermeable area = 0.32ha

Catchment 3e
Development area = 1.69ha
Impermeability = 60%
Impermeable area = 1.01ha

Catchment 3 – highways
Development area = 0.92ha
Impermeability = 100%
Impermeable area = 0.92ha

Catchment 3b
Development area = 1.12ha
Impermeability = 60%
Impermeable area = 0.67ha

Catchment 3a
Development area = 1.05ha
Impermeability = 60%
Impermeable area = 0.63ha

Catchment 3c
Development area = 2.12ha
Impermeability = 60%
Impermeable area = 1.27ha

Catchment 2a
Development area = 0.54ha
Impermeability = 60%
Impermeable area = 0.32ha

Borehole log BHSA02
Reference = 16118GI
Infiltration testing depth = 8.0m
Infiltration rate = $8.4x10^{-6}$m/s

Basin 2 & Wet Pond Feature

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels. Wet pond with 1 in 4 side slopes to provide treatment and amenities.

Target infiltration depth = 5.8m
Infiltration rate = $8.4x10^{-6}$ m/s
Anticipated infiltration area = $850m^2$
Water depth (1in100+45%CC) = 0.994m
Freeboard = 406mm
Basin plan area = $1030m^2$

Catchment 1c
Development area = 0.33ha
Impermeability = 60%
Impermeable area = 0.20ha

Catchment 1d
Development area = 0.47ha
Impermeability = 60%
Impermeable area = 0.28ha

Catchment 2 – highways
Development area = 0.47ha
Impermeability = 100%
Impermeable area = 0.47ha

Catchment 1f
Development area = 2.08ha
Impermeability = 60%
Impermeable area = 1.25ha

Catchment 1e
Development area = 0.44ha
Impermeability = 60%
Impermeable area = 0.26ha

Catchment 1 – highways
Development area = 1.16ha
Impermeability = 100%
Impermeable area = 1.16ha

Catchment 1b
Development area = 1.25ha
Impermeability = 60%
Impermeable area = 0.75ha

Catchment 1a
Development area = 1.55ha
Impermeability = 60%
Impermeable area = 0.93ha

Catchment 1g
Development area = 0.66ha
Impermeability = 60%
Impermeable area = 0.40ha

Basin 1

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels.

Target infiltration depth = 4.5m
Infiltration rate = $1.1x10^{-4}$ m/s
Anticipated infiltration area = $3100m^2$
Water depth (1in100+45%CC) = 0.995m
Freeboard = 405mm
Basin plan area = $3328m^2$

Borehole log BH2
Reference = 16118SI
Infiltration testing depth = 7.0m
Infiltration rate = $1.1x10^{-4}$m/s

Catchment 4a
Development area = 1.09ha
Impermeability = 60%
Impermeable area = 0.65ha

Borehole log BHSA06
Reference = 16118GI
Infiltration testing depth = 8.0m
Infiltration rate = $3.6x10^{-5}$m/s

Catchment 5a
Development area = 0.92ha
Impermeability = 60%
Impermeable area = 0.55ha

Borehole log BHSA07
Reference = 16118GI
Infiltration testing depth = 8.0m
Infiltration rate = $2.4x10^{-5}$m/s

Basin 5

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels.

Target infiltration depth = 5.8m
Infiltration rate = $2.4x10^{-5}$ m/s
Anticipated infiltration area = $198m^2$
Water depth (1in100+45%CC) = 0.962m
Freeboard = 438mm
Basin plan area = $898m^2$

Basin 4

Surface water detention basin with inlet forebay, 1 in 4 side slopes and an infiltration system below targeting the deeper gravels.

Target infiltration depth = 6.1m
Infiltration rate = $3.6x10^{-5}$ m/s
Anticipated infiltration area = $318m^2$
Water depth (1in100+45%CC) = 0.777m
Freeboard = 623mm
Basin plan area = $1142m^2$

Drainage Key

Surface Water

- Indicative pipe routes
- Indicative swale routes
- Indicative surface water detention basins

Catchment Key

Surface Water

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. The information contained within this drawing is subject to discussion and agreement with the local authority and all relevant planning consultees.
2. Borehole logs have been taken from RSA Geotechnics Ltd documents:
   - Geotechnical and Geoenvironmental Interpretative Report ref 16118SI dated November 2022
   - Borehole logs ref 16118GI dated 27.02.24
3. Infiltration results have been taken from RSA Geotechnics Ltd documents:
   - Geotechnical and Geoenvironmental Interpretative Report ref 16118SI dated November 2022
   - Soakage tests ref 16118GI dated 27.02.24

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P01	29.02.24	Preliminary issue.	AS	TRF	RD

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Client
BARRATT DAVID WILSON HOMES
HOPKINS HOMES

Project Title
HUMBER DOUCY LANE, IPSWICH

Status
PLANNING

Drawing Title
PROPOSED SURFACE WATER DRAINAGE STRATEGY

Drawn	Date	Checked	Date	Approved	Date
AS	29.02.24	TRF	29.02.24	RD	29.02.24

Scale	Orig Size	Dimensions
1:1250	A0	m

Project No.: 890695
Drawing File: 890695-RSK-ZZ-XX-DR-C-0007-Proposed Surface Water Drainage Strategy.dwg

Drawing No.

Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	Rev.
890695	RSK	ZZ	XX	DR	C	0007	P01

Scale 1:1250
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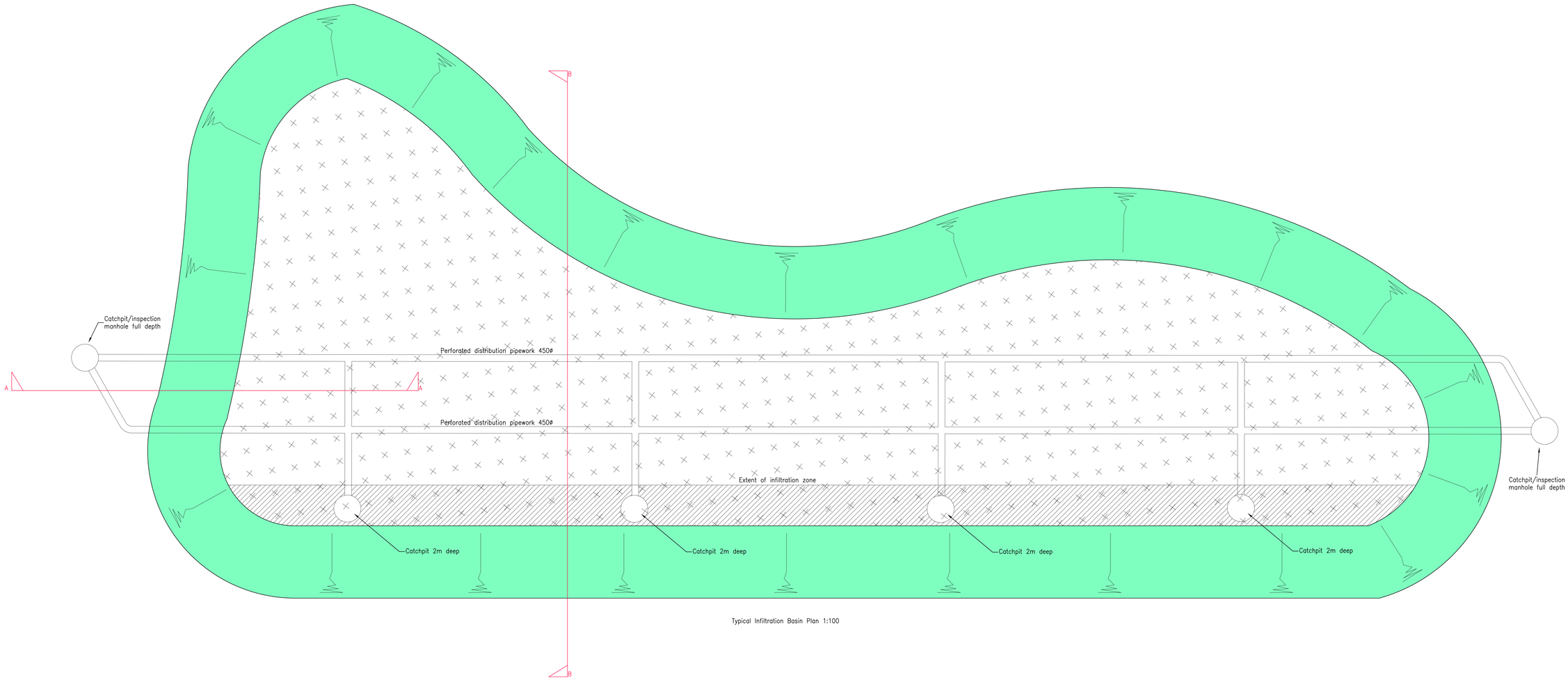
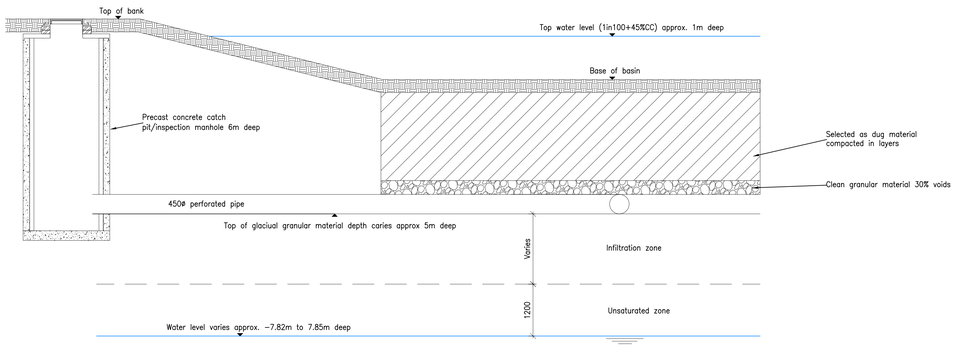
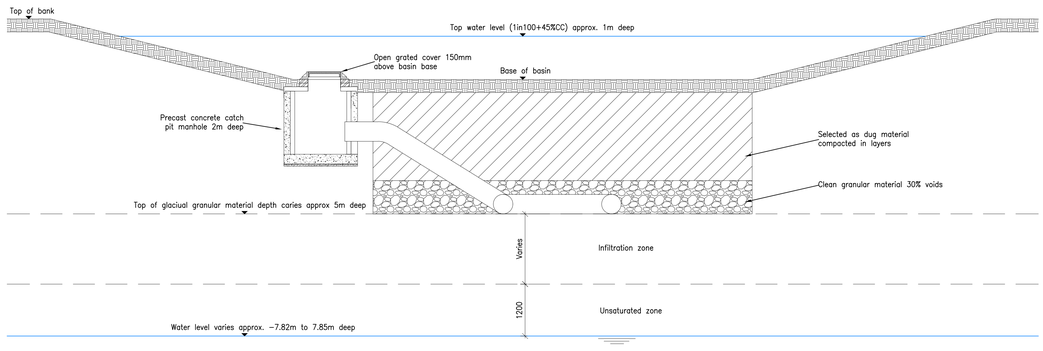
APPENDIX J
PROPOSED SURFACE WATER DRAINAGE DETAILS



Typical Infiltration Basin Plan 1:100



Typical Infiltration Basin Section A – A 1:50



Typical Infiltration Basin Section B – B 1:50

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. The information contained within this drawing is subject to discussion and agreement with the local authority and all relevant planning consultees.

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P01	29.02.24	Preliminary issue.	AS	TRF	RD

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HOPKINS HOMES

Project Title
HUMBER DOUCY LANE, IPSWICH

Status
PLANNING

Drawing Title
PROPOSED SURFACE WATER DRAINAGE DETAILS

Drawn	Date	Checked	Date	Approved	Date
AS	29.02.24	TRF	29.02.24	RD	29.02.24

Scale	Orig Size	Dimensions
1:1250	A0	m

Project No.: 890695
Drawing File: 890695-RSK-ZZ-XX-DR-C-0010-Proposed Surface Water Drainage Details.dwg

Drawing No.: 890695 | RSK | ZZ | XX | DR | C | 0010 | Rev. P01
(Project | Orig. | Vol./Sys. | Lev./Loc. | Type | Role | Draw. No.)

Scale 1:100
0 1 2 3 4 5m

APPENDIX K
SUDS MANAGEMENT STRATEGY

Barratt David Wilson Homes and Hopkins Homes

Land off Humber Doucy Lane, Ipswich

Sustainable Drainage System (SuDS) Management Strategy

890695

29 FEBRUARY 2024

RSK GENERAL NOTES

Project No.: 890695-R1(0)

Title: SuDS Maintenance Schedule – Humber Doucy Lane, Ipswich

Client: Barratt David Wilson Homes and Hopkins Homes

Date: 29 February 2024

Office: RSK Land and Development Engineering Ltd, Abbey Park, Humber Road, Coventry, CV3 4AQ

Status: Final

Author	Thomas Fillingham	**Technical reviewer**	Rupert Domoney
Signature		Signature	
Date:	29.02.24	Date:	29.02.24

Issue No	Version/Details	Date issued	Author	Reviewed by	Approved by
0	Final	29.02.24	TRF	RD	

CONTENTS

1 INTRODUCTION

This management strategy has been prepared by RSK Land and Development Engineering Ltd on behalf of Barratt David Wilson Homes and Hopkins Homes, to satisfy planning conditions related to Land off Humber Doucy Lane, Ipswich.

The SUDS considered for the purposes of this statement, include drainage features that will be employed to reduce and manage surface water runoff from the development to a design return period of One hundred years plus climate change. This is required so that The Development will not increase the risk of flooding to the site and its environs. All drainage on site is taken to the underlying strata via infiltration features. Such features include the following:

- *Permeable paving;*
- *Detention Basins with Infiltration*
- *Swales*
- *Catchpit Manholes*
- *Sewer Mains*
- *Gullies and Linear Drainage Channels*
- *Headwalls*

This document outlines the long-term maintenance of the proposed surface water system and will refer to the following documents, some of which provide further detail on the maintenance operations required:

- CIRIA Report C753, *'The SUDS Manual'*, 2015
- CIRIA Report C625, *'Model Agreements for Sustainable Water Management Systems'*, 2004; and
- Interpave, *'Permeable pavements: Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements'*, ed. 4, 2006.

2 MAINTENANCE RESPONSIBILITIES

Responsibility for drainage within England and Wales rests with various bodies. For the Development, the drainage responsibilities will be divided between the following:

- **Private Landowner** – each Householder will be responsible for the maintenance of drainage features within individual property curtilages.
- **Communal Areas** - A Management company will be set up for the Development to maintain all permeable paving and any associated flow controls within communal areas. However, it should be noted that if, the Flood and Water Management Act 2010 is ever fully implemented this allows a surface water drainage system to be vested to the SuDS approving body (SAB) in this case Suffolk County Council. This would be reviewed at the time of any implementation of the act.
- **Adoptable Drainage –** All drainage within the adoptable areas will be offered for Section 104 Agreement adoption under an inset agreement with a NAV company/Anglian Water to be determined at a later date. All drainage will be designed and constructed to adoptable standards in accordance with Design and Construction Guidance (App C Sewerage Sector Guidance) and the adopting authority's requirements.
- **During Construction –** Until the drainage is approved and adopted by the adopting authorities, it is the responsibility of the groundworks contractor to protect the drainage system from construction run-off and effluent during the construction process. It will also be their responsibility to ensure that the drainage network is maintained, and functions as intended.

3 MAINTENANCE REGIME

The following section describes the required maintenance for each feature in turn. The SuDS maintenance requirements listed below should be reviewed after the first 5 years, with a view to agreeing a new regime for the ongoing maintenance.

Notwithstanding the routine inspections and maintenance requirements, after severe storm events all features shall be inspected to clear debris and repair damaged structures or features. Records of the maintenance carried out shall be prepared by the Management Company.

3.1 Permeable Paving

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three monthly 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

3.2 Detention Basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), as or required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), the annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

3.3 Swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass- to retain grass height within specified design range	Monthly (during growing season), or as required

Maintenance schedule	Required action	Typical frequency
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspection inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design level	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of soil surface	As required
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

3.4 Soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year then annually
	Check soakaway to ensure emptying is occurring	Annually

3.5 Operation and Maintenance Requirements for Trees

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly or as required
	Manage other vegetation and remove nuisance plants	Monthly
	Inspect inlets and outlets	Monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually
	Water	As required
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

3.6 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures,	Monthly

Maintenance schedule	Required action	Typical frequency
	pipework etc for evidence of blockage and/or physical damage	
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once build-up has occurred to inform management and disposal options	Half yearly
	Check any mechanical devices, e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. every 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows	As required

3.7 Catchpit Manhole

Maintenance schedule	Required action	Typical frequency
Occasional maintenance	Remove litter, debris, and detritus that enters the drainage system	Annually, or as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Annually, or as required
	Inspection inlets and sump for silt accumulation, establish appropriate silt removal frequencies	Annually, or as required
Remedial actions	Remove and dispose of silt	Annually, or as required
	Remove and dispose of oils or petrol residues using safe standard practices	Annually, or as required

3.8 Sewer Mains

Maintenance schedule	Required action	Typical frequency
Monitoring & Occasional maintenance	CCTV Survey pipe network to check system is functioning correctly and that there are no cracks in the pipework.	Every 5 years
	Removal of blockages reported in the pipe network will also require a full CCTV Survey of the pipe network afterwards to confirm there are not any other blockages.	As required

3.9 Gullies & Linear Drainage Channels

Maintenance schedule	Required action	Typical frequency
Regular inspections	Remove litter, debris, and detritus that enters the gullies or linear drainage channels	Six monthly, or as required
	Inspect inlets and outlets for blockages, and clear if required	Six monthly, or as required
	Inspection of sump for silt accumulation, establish appropriate silt removal frequencies	Six monthly, or as required
Remedial actions	Remove and dispose of silt	Six monthly or as required
	Remove and dispose of oils or petrol residues using safe standard practices	Six monthly or as required

3.10 Headwall

Maintenance schedule	Required action	Typical frequency
Occasional Monitoring & Maintenance	Check for cracking or other damage to headwall structure	Annually or as required
	Check for erosion of the spillway	Annually or as required
Remedial actions	Repair cracking or other damage to headwall structure	As required
	Repair excessive erosion of spillway if it detrimentally affects	As required

3.11 Root Barrier

Maintenance schedule	Required action	Typical frequency
Monitoring & Occasional maintenance	Inspect root barrier for defects.	Annually or as required
	Replace root barrier.	As required

APPENDIX A
INSPECTION CHECKLIST

General information			
Site ID			
Site location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved drawing reference	
Inspection frequency		Approved specification reference	
Type of development		Specific purpose of any parts of the scheme (e.g. biodiversity, wildlife and visual aspects)	

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
General inspection items								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Silt/Sediment accumulation								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent. Is removal required? If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)								
Is surface clogging visible potentially problematic where water has to soak into the underlying construction or ground (e.g. underdrained swale or infiltration basin)?								

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
Does permeable or porous surfacing require sweeping to remove silt?								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging or blockage of outlets or drainage paths?								
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (check against approved planting regime)								
Does any part of the system require weeding, pruning or mowing? (check against maintenance frequency state in approved design).								
Is there any evidence of invasive species becoming established? If yes, state action required								
Are any check dams or weirs in good condition?								
Is there any evidence of any accidental damage to the system (e.g. wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow control?								
Are there any other matters that could affect the performance of the								

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects?								
Other observations								
Information appended (e.g. photos)								
Continue as current Increase maintenance Decrease maintenance								
Proposed date for next inspection								

APPENDIX L
ANGLIAN WATER PRE-PLANNING ENQUIRY

Pre-Planning Assessment Report

Humber Doucy Lane

InFlow Reference: PPE-0202525

Assessment Type: Used Water

Report published: 21/02/2024

Thank you for submitting a pre-planning enquiry.

This has been produced for RSK.

Your reference number is **PPE-0202525**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **07929 786 955** or email planningliaison@anglianwater.co.uk

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Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	**No. Of units**
Dwellings	675

The anticipated residential build rate is:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12
Build rate	50	50	50	50	50	50	50	50	50	50	50	125

Development type: Greenfield

Planning application status: Unknown

Site grid reference number: TM1871246786

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2 - Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information		
Asset type	Pipe size (mm)	Total easement required (m)
Water mains	400	6.00 m overall easement
Water mains	209	6.00 m overall easement
Water mains	203	6.00 m overall easement
Water mains	196	6.00 m overall easement
Water mains	152	6.00 m overall easement
Water mains	148	4.50 m overall easement
Sewer mains	300	3.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	300	3.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

Water recycling centre

The foul drainage from the proposed development is in the catchment of Ipswich-Cliff Quay Raeburn Water Recycling Centre, which currently has capacity to treat the flows from your development site. Anglian Water cannot reserve capacity and the available capacity at the water recycling centre can be reduced at any time due to growth, environmental and regulation driven changes.

Used water network

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from of the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 300 mm internal diameter pipe is required to drain the development site. We have assessed your preferred connection point which is to the 300mm combined sewer at 5501 located in Humber Douncy Lane at National Grid reference (NGR)TM 18591 46524 . Unfortunately the cover level and the invert level are not available in our mapping systems. Anglian Water has assessed the impact of gravity flows from the planned development to the public foul sewerage network. We can confirm that this is acceptable as the foul sewerage system, at present, has available capacity for your site. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

Whilst there is a public surface water sewer within the vicinity of the site, it eventually discharges into a combine sewer downstream. The impact of additional surface water flow to a combined sewer will be to significantly increase the risk of flooding and pollution from the receiving network and potentially to compromise the ability ofassets to operate within statutory enforced permitted limits. Anglian Water's position reflects both the SUDs hierarchy and broadly held concern to minimise pollution risk from new development. As such, we would only consider a connection of additional surface water into a combined sewer if all other disposal options are confirmed to be technically unfeasible. Detailed analysis will be required to establish the extent of network reinforcement required to accommodate the additional flow. As the developer is responsible for providing the appropriate surface water disposal infrastructure, work to determine the feasibility of a connection to a public sewer is considered to bepart of the developer's evaluation of surface water disposal options to a consented outfall. If you wish to proceed with the evaluation of a connection to the public sewer, a cost and timescale estimate for this analysis can be provided in an addendum to this report.

Anglian Water needs to ensure the surface water hierarchy has been followed. We require you to liaise with LLFA as they are the Statutory Consultee for all surface water drainage strategies on major development sites and are required by law to advise on the broader area drainage constraints.If they are satisfied that, based upon evidence, no other option is technically feasible then a connection point may be made to the combined sewer, subject to there being existing capacity or the provision of network reinforcement to accommodate the flow. Please note that we will require evidence to demonstrate discussions with the LLFA have taken place and that the drainage strategy has been approved by them. As the impact of additional hydraulic loading from surface water could effect a wide array of assets, it may not be possible to provide the site with a feasible solution of surface water disposal within the existing network. Consequently, the reinforcement work necessary to mitigate the risks posed could be complex and extensive.

Anglian Water will request a planning condition to ensure no additional flow will be connected until sufficient capacity and permit allowance in the network has been confirmed

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

Your development site will be required to pay an Infrastructure charge for each new property connecting to the public water and sewerage network that benefits from Full planning permission. The infrastructure charge replaces the zonal charge as previously identified.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991.

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

- The Infrastructure Charge is based on the cost of any reinforcement and upgrades to our existing network ("Network Reinforcements"), whether designed to address strategic or local capacity issues. For more informationon our Infrastructure Charge, please see the 'Useful Information' section of this report.

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage).

The Water Recycling Infrastructure charge for your dwellings is:

Infrastructure charge	Number of units	Total
£ 400	675	£270,000.00

Please note that you should also budget for infrastructure charges on non-household premises where applicable and these will be calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge and the relevant multiplier will be applied to the figures set out in our 2023-24 Developer Charging Arrangements to arrive at the amount payable. Details of the relevant multiplier for each fitting can be found on our website.

Section 4 - Map of Proposed Point of Connection(s)

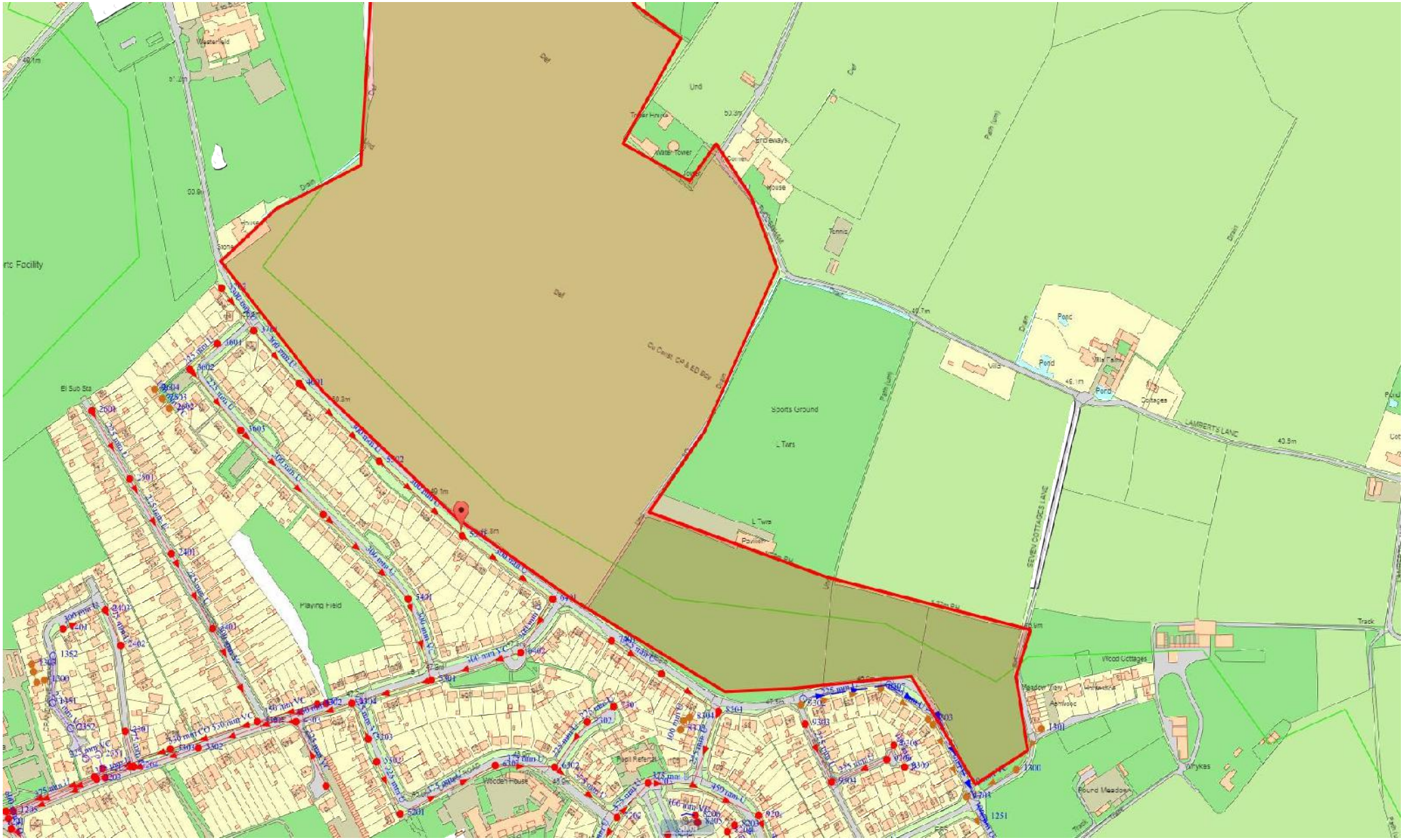

Figure 1:Showing your water recycling foul point of connection

Section 5 - Useful information

Water Industry Act – Key used water sections

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website or via our Development Services team on **0345 60 66 087**.

Sustainable drainage systems

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section104 application ahead of a Section 106 connection

Encroachment

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from digdat

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our website

Charging arrangements

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our website

Section 6 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content.

Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid from the date issued and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s). Our pre-planning reports are valid for 12 months, however please note Anglian Water cannot reserve capacity and available capacity in our network can be reduced at any time due to increased requirements from existing businesses and houses as well as from new housing and new commercial developments.

APPENDIX M
PROPOSED FOUL WATER DRAINAGE STRATEGY

Foul Pumpstation to be accessed off an adoptable estate road, designed in accordance with the "Design and Construction Guidance for foul and surface water sewers offered for adoption agreements for water and sewerage companies operating wholly or mainly in England" (DCG) Approved Version 2.0 10 March 2020.
Type 3 Pumpstation 15m from habitable dwellings the pumpstation compound to be a minimum size of 8m x 10m.

Foul rising main to outfall in to adopted gravity foul water system.

Proposed connection for up to 675 dwellings into existing Anglian Water combined sewer in accordance with Anglian Water Pre Planning Assessment Report PPE-0202525

Foul Pumpstation to be accessed off an adoptable estate road, designed in accordance with the "Design and Construction Guidance for foul and surface water sewers offered for adoption agreements for water and sewerage companies operating wholly or mainly in England" (DCG) Approved Version 2.0 10 March 2020.
Type 3 Pumpstation 15m from habitable dwellings the pumpstation compound to be a minimum size of 8m x 10m.

Drainage Key

Foul Water

- Indicative pipe routes
- Indicative rising main routes
- Indicative pumpstation location

Catchment Key

Foul Water

- Catchment 1
- Catchment 2
- Catchment 3

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:-

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. The information contained within this drawing is subject to discussion and agreement with the local authority and all relevant planning consultees.

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P01	29.02.24	Preliminary issue.	AS	TRF	RD

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Client

BARRATT DAVID WILSON HOMES
HOPKINS HOMES

Project Title

HUMBER DOUCY LANE, IPSWICH

Status

PLANNING

Drawing Title

PROPOSED FOUL WATER DRAINAGE STRATEGY

Drawn	Date	Checked	Date	Approved	Date
AS	29.02.24	TRF	29.02.24	RD	29.02.24

Scale	Orig Size	Dimensions
1:1250	A0	m

Project No.: 890695
Drawing File: 890695-RSK-ZZ-XX-DR-C-0008-Proposed Foul Water Drainage Strategy.dwg

Drawing No.

Project	Org.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	Rev.
890695	RSK	ZZ	XX	DR	C	0008	P01

Scale 1:1250
0 25 50 75 100m